Prompt γ-rays as a probe of nuclear dynamics with PARIS@IPNO

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The angular momentum transferred to fission-like fragments in the near barrier reaction $^{32}S(E_{lab} = 166$ MeV) + ^{197}Au was investigated by measuring prompt γ-rays coincident with the binary reaction products. For this purpose, the high efficiency γ-ray spectrometer ORGAM [1] and the future PARIS [2] photon calorimeter were coupled to the double arm time-of-flight spectrometer for fission fragments CORSET [3].

The CORSET two-arm time-of-flight spectrometer based on micro-channel plates, used as a trigger for PARIS and ORGAM, is optimal for measuring binary products of nuclear reactions. It gives access to the two fission-fragment-like products in coincidence. The mass resolution amounted to 2-3 amu for the chosen short flight-path and a kinetic energy resolution of a few MeV was derived. Thus, several relevant characteristics of the reaction products, i.e. mass and total kinetic energies were accessible.

The PARIS phoswich detectors ensured adequate n-γ separation by time-of-flight, which made possible to estimate the dependence of the multiplicity of γ-rays emitted from both fragments on their mass, Mγ(A) and TKE, Mγ(TKE). A tentative way of separating the resulting angular momentum transferred to each fragment is proposed based on the proportionality to their mass. An enhancement associated with the excitation modes is observed as the results are compared to the statistical model.

Details on the experimental setup, methods of processing the acquisitioned data and results on the nuclear dynamics illustrated with the $^{32}S + ^{197}Au$ reaction will be discussed.

References:

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